PRIMERAS JORNADAS DE HIDRÓGENO

OPORTUNIDADES INTERNACIONALES
DEL HIDRÓGENO PARA LA ARGENTINA

CAI

PRIMERAS JORNADAS DE HIDRÓGENO

CAI

Visión estratégica del Hidrógeno en la Argentina

Taehyung Kim

Group Head of Hydrogen Business Office, POSCO

- **Education**
  - 1991 Seoul National University
    : Bachelor of Metallurgical Engineering
  - 2002 Emory University MBA

- **Professional Experience**
  - 2006 Director of Hydrogen·Fuel Cell Business Team, Investment Business Office, POSCO
  - 2010 Director of Strategy and Marketing Group, Fuel Cell Business Office, POSCO ENERGY

PRIMERAS JORNADAS DE HIDRÓGENO

OPORTUNIDADES INTERNACIONALES DEL HIDRÓGENO PARA LA ARGENTINA

posco

With POSCO

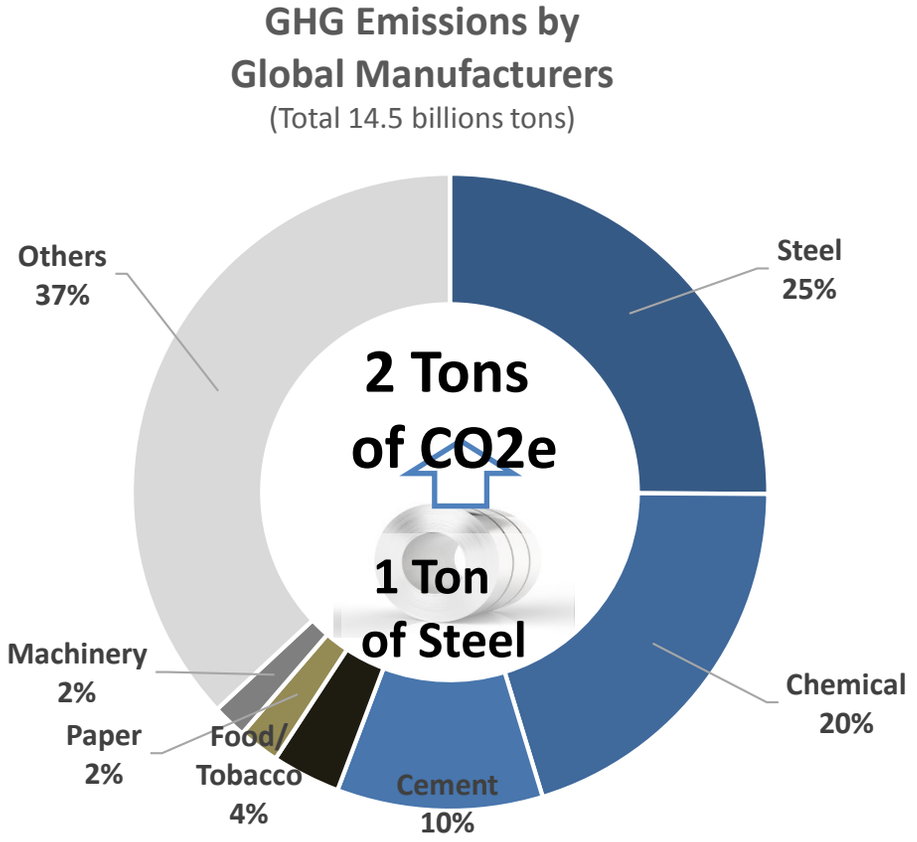
Future of Hydrogen Economy and POSCO's Hydrogen Business strategy

November 25th

1. POSCO, the largest hydrogen demand company

With POSCO

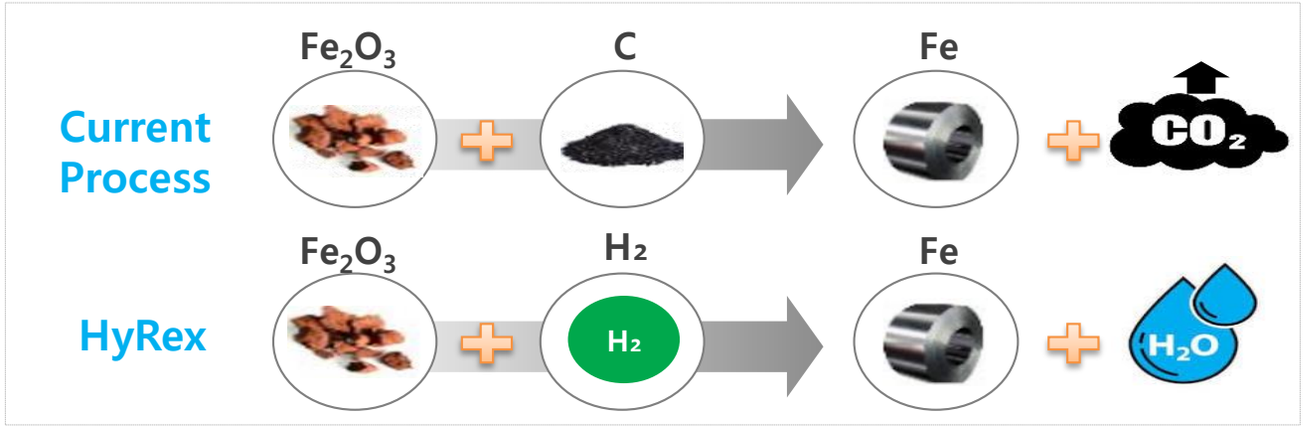
- **Transition to hydrogen-based production system is crucial for Posco's carbon reduction**



Source : Climate Watch, the World Resources Institute(2020)

【 H2 as the essential material for future steel-making 】

○ **HyREX technology is essential for transition to eco-friendly steel-making process**



When POSCO's crude steel production goes 100% hydrogen
(38 Mt)

3.75 million tons of annual hydrogen consumption
(22% of domestic hydrogen demand in 2050)

*HyREX: Hydrogen Reduction Process

2. POSCO's Strategy – ① Global Supply Chain

With POSCO

- **POSCO to secure global supply chain for stable supply of hydrogen**

Gradual transition to green hydrogen

By-product

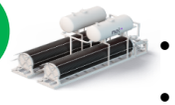
Present: 7k tons of hydrogen production capacity → Future: Capacity expansion to 70k tons

Blue

Overseas: Gas field → Hydrogen production → Ammonia synthesis
Domestic: Hydrogen separation

CO_2 EOR(Enhanced Oil Recovery) & storage

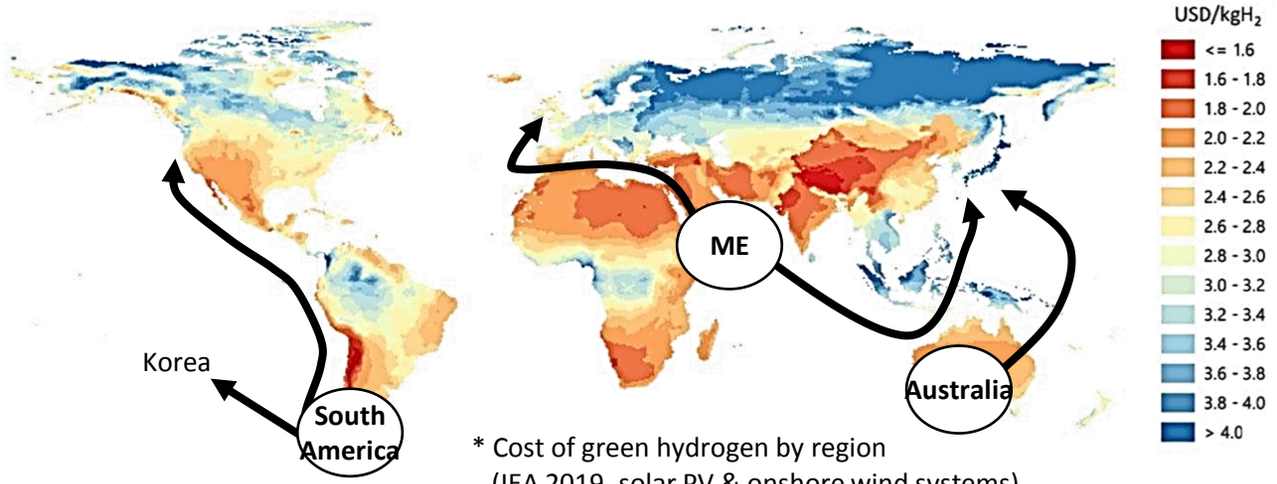
Green



- **Green hydrogen production & imports from overseas**
- **R&D/investment in water electrolysis**
- **Long-term plan to produce green hydrogen in Korea**

* POSCO's hydrogen supply roadmap

Hydrogen production bases in key regions to import to Korea and sell overseas



* Cost of green hydrogen by region (IEA 2019, solar PV & onshore wind systems)

Production bases in key regions
Australia, Middle East, South America

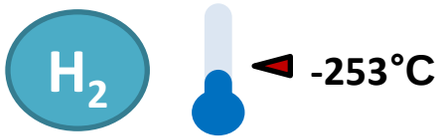
→ **Import to Korea**
→ **Sales to North America & Europe**

3. POSCO's Strategy – ② Techology

With POSCO

- **POSCO to develop technology for ammonia hydrogen extraction technology**

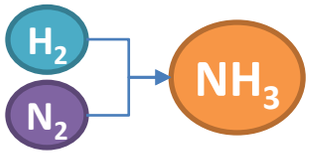
Cryogenic liquefaction



Liquefaction at -253°C

- High cost/energy because cryogenic facility, dedicated ship are needed
- Carrier development stage

Ammonia



Gas
·
Liquid

Systhesize Hydrogen to Ammonia

- **Carrying largely amount**
- **Utilize existing infrastructure**
- Extraction technology development stage

LOHC (Liquid Organic Hydrogen Carrier)

Systhesize Hydrogen to MCH

- Low energy density, toxicity
- Require high energy
- Synthesis/extraction technology development stage

Development of ammonia hydrogen extraction technology

KIST*	University	Engineering Partner
Technology for Catalyst/membrane	Hydrogen separation	Process design

→ **RIST**** (Hydrogen Research Center)

*KIST: Korea Institute of Science and Technology
**RIST: Research Institute of Industrial Science & Technology

※ Additional collaboration with overseas specialized companies and technology holders

【 Establish infrastructure 】

○ Ammonia/hydrogen receiving terminal and domestic distribution infrastructure

4. POSCO's Strategy – ③ Utilization – Self Consumption

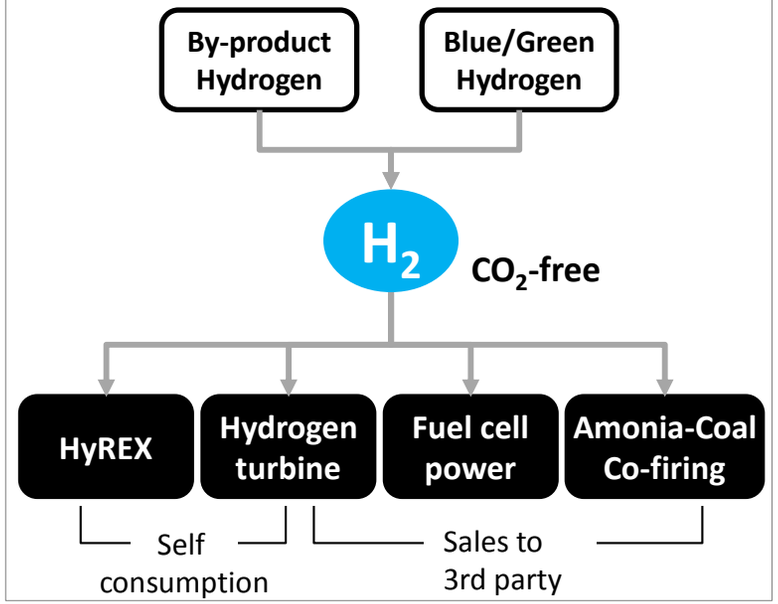
With POSCO

- **Goal of 100% hydrogen reduction development, hydrogen turbine conversion, CO_2-free hydrogen mass supply**

【 Hydrogen Supply 】

○ **Capitve for HyREX or Gas turbine, Low-cost bulk supply for industrial usage**

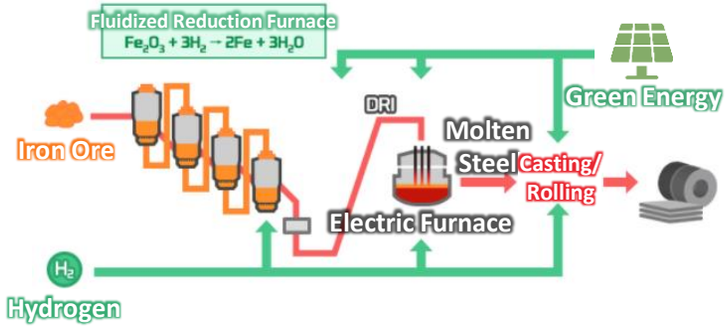
POSCO's production of hydrogen



【 Hydrogen Direct Reduction 】

○ **100% * HyREX development by 2050, 3.8M tons of hydrogen required**

(22% of domestic demand)



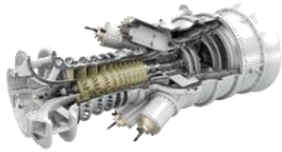
Present	2040	2050
National project	Complete development	Conversion to HyREX

* HyREX: Hydrogen Reduction Process

【 Gas Turbine Power 】

○ **2M+ tons of hydrogen required**

(When POSCO Group fully transitions to hydrogen use in its gas-powered plants)



POSCO Group's gas-powered plants capacity: 6.5GW

Short term
- **Expand shares of LNG+H_2 mix in gas turbine**

Long term
- **100% H_2 mix in hydrogen gas turbine**

5. POSCO's Strategy – ④ Market – Clean Hydrogen Energy Portfolio Standard(CHPS)

- **Korea Government is reducing greenhouse gases through operationg hydrogen power generations**

Korea Government		POSCO Market Development Activity
Hydrogen turbine	• Demonstration('23~) • Commercialization('30~)	• **Joint develop. of co-firing turbine with Doosan Heavy , glabal top 5 turbine manufacturer** - Hydrogen produced by partially reforming ammonia, Development of a turbine that combusted ammonia mixed gas - Hydrogen demand for gas turbines in Korea: 390thousand tons ('30)→ 3000,000 tons ('50) · Incheon Combined Power Plant (Captive LNG power plant, 3.4GW) demands : 40,000T ('26~) → 130,000T ('35~)
Fuel cell power	• 3.7GW by 2030	• **40MW hydrogen fuel-cell project near Gwangyang Works** - Supply of 20,000 ton/year by-product hydrogen as power generation fuels - Formed a consortium with power generation companies with extensive experience - Preliminary F/S in progress for business profitability evaluation
Amonia-Coal Co-firing	• 20% co-firing by 2030	• **Development and application of coal-ammonia co-firing technology with KEPCO** - Source technology development (~'24), Pilot Test (~'25), demonstration (~'27) - Domestic Coal Power Plant Ammonia Demand : 11,000,000T ('30) → 12,000,000T ('50) · Samcheok Blue Power (Captive coal power plant, 2.1GW) demand : 1,000,000T ('30~)

6. POSCO's Strategy – ④ Market – Industrial Hydrogen

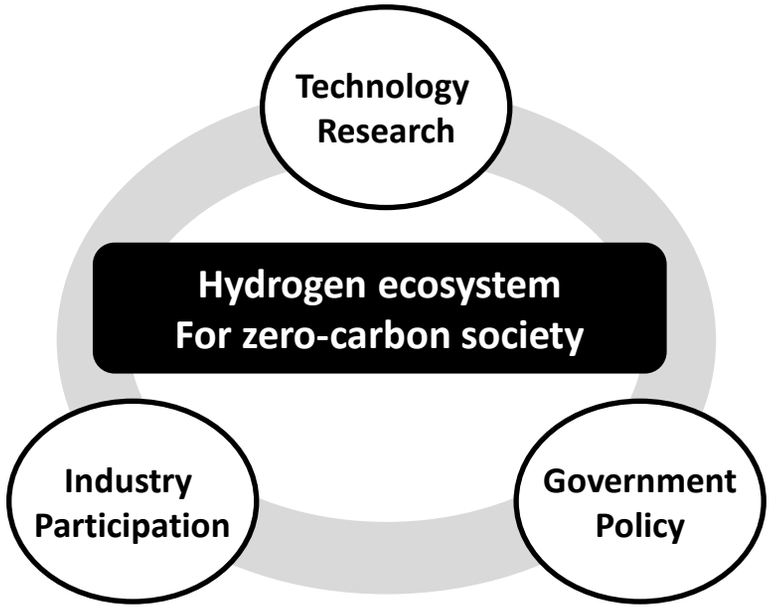
- **Korea Government is achieving eco-friendly industrial structure by using clean hydrogen**

Korea Government		POSCO Market Development Activity
Oil & Petrochemical	• **Bio Naphtha / Bio Diesel** • **e-Fuel**	• **Hydrogen Market for Oil & Petrochemical Field** - Hydrotreated Vegetable Oil (Bio Naphtha, Bio Dieasel) * Bio-naphtha, bio-diesel, etc. can be produced through hydrogenation reaction of waste cooking oil * HVO production scale will be increased from 12M ton at present to 24M ton in 2024 - E-Fuel produced by synthesizing green hydrogen & CO2 * Carbon neutrality can be realized by synthesizing green hydrogen obtained by electrolysis of water and captured CO2 * In the mid- to long-term, hydrogen demand is expected to increase not only automobiles, but also ships, aviation, and heating.
Mobility	• **FCEV** (1st place) • **Hydrogen Refueling stations** (fastest)	• **Converting vehicle within POSCO steelworks to pollution-free FCEV.** - 1,500 vehicles will be replaced with FCEV gradually - Building hydrogen supply infrastructure at main works

7. Goal to be Korean hydrogen leading company

With POSCO

- **Proactively participate in vitalizing hydrogen economy, fostering hydrogen business as new growth engine**



POSCO

Vision of hydrogen business as new engine for long-term growth

2050 Businese Target

Capacity	5	Mil tons
Sales	30	Bil USD
Domestic M/S	30	%

Hydrogen utilization/production

Hydrogen business as core growth axis

Contributing to national hydrogen ecosystem

As corporate citizenship which is POSCO's management philosophy,
POSCO group plans to lead for Korea's zero carbon and fostering hydrogen ecosystem

www.cai.org.ar